REMARKS

Applicant has reviewed and considered the Office Action dated May 9, 2007 and the cited references therein. In the Office Action, the Examiner rejected Claims 19, 24-42, and 45 under 35 U.S.C. § 102(e). The Examiner further rejected Claim 20 under 35 U.S.C. § 103(a). In response thereto, Claims 19, 20, 28, 31, 34, and 37 have been amended and new Claim 46 has been added. No new matter has been added by these amendments. In view of the amendments and the following remarks, Applicant requests reconsideration and allowance of the pending claims.

Double Patenting Rejection

Claims 19-20, 24-42 and 45 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-26 of co-pending Application No. 10/461,307. Applicant submits a terminal disclaimer herewith obviating the basis for the rejection.

Rejections Under 35 U.S.C. § 102

Claims 19, 24-42, and 45 are rejected under 35 U.S.C. § 102(e) as being anticipated by Branton et al. (U.S. Patent No. 6,627,067). Applicant respectfully traverses the rejection for at least the following reasons.

Claim 19 is directed to a method of forming a membrane structure for use in a device to characterize polymer molecules. The method comprises, in part, "electron beam milling a nano-scale channel entirely through a self supporting portion of the thin film; and measuring the channel in-situ, wherein the milling and measuring are performed during a single presentation to an instrument."

Branton Does Not Disclose Electron Beam Milling

As an initial matter, Branton does not disclose, teach, or suggest "electron beam milling a nano-scale channel entirely through a self supporting portion of the thin film." Rather, Branton

discloses microfabrication of an aperture in a solid-state membrane that requires two steps, neither of which comprises "electron beam milling."

To create the aperture using the Branton method, each of the following steps is required. First, a cavity is etched in the membrane 134 as shown in Branton Fig. 4G. *See* Branton, Col. 13, ll. 3-5. This cavity is a "blind hole." That is, the cavity does not breach both sides of the membrane 134. In fact, the cavity terminates "at an interior point in the membrane." Branton, Col. 13, ll. 45-46 (emphasis added); Fig. 4G. Furthermore, the dimensions of the cavity created can be, and are designed to be, much larger than the final diameter of the aperture. Branton, Col. 13, ll. 42-45. This cavity-forming step is performed with a lithographic instrument. Branton, Col. 13, ll. 5-18.

After the cavity has been lithographically etched partially through the membrane 134, the membrane is "thinned" until the thinning intersects the narrow bottom portion of the pre-etched cavity, thereby creating an aperture, or thru-hole. Branton, Col. 13, li. 56 - Col. 14, li. 13. In fact, "the aperture formation process of the invention relies on structural thinning, rather than lithography, to define the final aperture geometry." Branton, Col. 13, ll. 38-40. The step of structural thinning is required in the Branton method because the cavity created in the first step has too large a diameter, for the stated purpose of molecular and atomic scale evaluation of biopolymers, to be formed entirely through the membrane and used as the final aperture. Thus, both steps of blind cavity creation and thinning to intersect the cavity are required to create a "nano-scale channel entirely through a self-supporting portion of the thin film."

The Examiner first points to Branton Column 13, lines 3-17 and Column 13, line 55-Column 14, line 34 and asserts that electron beam lithography is equivalent to electron beam milling "because each is employed to remove the thin film in order to create a hole therethrough." Applicant respectfully, though strongly, traverses the Examiner's assertion for at least the following reasons.

Branton does not disclose electron beam milling of the cavity. Rather, Branton discloses electron beam lithography or photolithography of the cavity. Branton, Col. 13, ll. 3-17. As is well known in the art, during electron beam lithography, the electron beam is used only to

expose the electron beam resist layer, such as PMMA for example, which is then developed leaving a void in the resist layer, where the resist layer was exposed by the electron beam. The cavity in the resist layer is subsequently exposed to an etchant, typically a reactive ion plasma gas of CF4, CHF3, or SF6. *See* Branton, Col. 13, ll. 25-27 ("a relatively isotropic etch process, e.g., a reactive ion etch process, is carried out to form a bowl-shaped cavity . . .)." Such relatively isotropic etch processes result in a cavity that does not have vertical side walls. In any event, electron beam lithography and electron beam milling are not equivalent. Thus, Branton does not disclose electron beam milling of the cavity.

Branton, however, discloses electron beam etching or assisted etching as an additional thinning process for enabling "controlled thinning of a structure to intersect a cavity on a surface opposite that being thinned." Branton, Col. 14, ll. 13-19. That is, Branton discloses electron beam etching or assisted etching for purposes of carrying out the second step of the two-step process, i.e., the thinning step. As is typically understood in the art, electron beam etching means electron assisted chemical etching. Branton discloses that electron beam etching comprises structural thinning in order to create a completed aperture through the membrane 134. The invention, in fact, "relies" on structural thinning otherwise the aperture created would be too large for the stated purpose. As such, Applicant respectfully asserts that Branton does not disclose electron beam milling, which is the entirely different and novel technique disclosed by Applicant.

The Examiner further points out that, in Paragraph [0042], Applicant states "a channel 75 is cut through thin film 60 with a focused ion beam 70 or other suitable precision milling device such as electron beam lithography" and incorrectly asserts that Applicant therefore states that electron beam lithography is an equivalent precision milling device capable of making a precise aperture. Office Action dated May 9, 2007, p. 4. Applicant respectfully points out to the Examiner that in Paragraph [0043], immediately following the quote that the Examiner points to, Applicant discusses electron beam milling as an alternative to milling with a focused ion beam or electron beam lithography. Applicant does not equate electron beam lithography to electron beam milling.

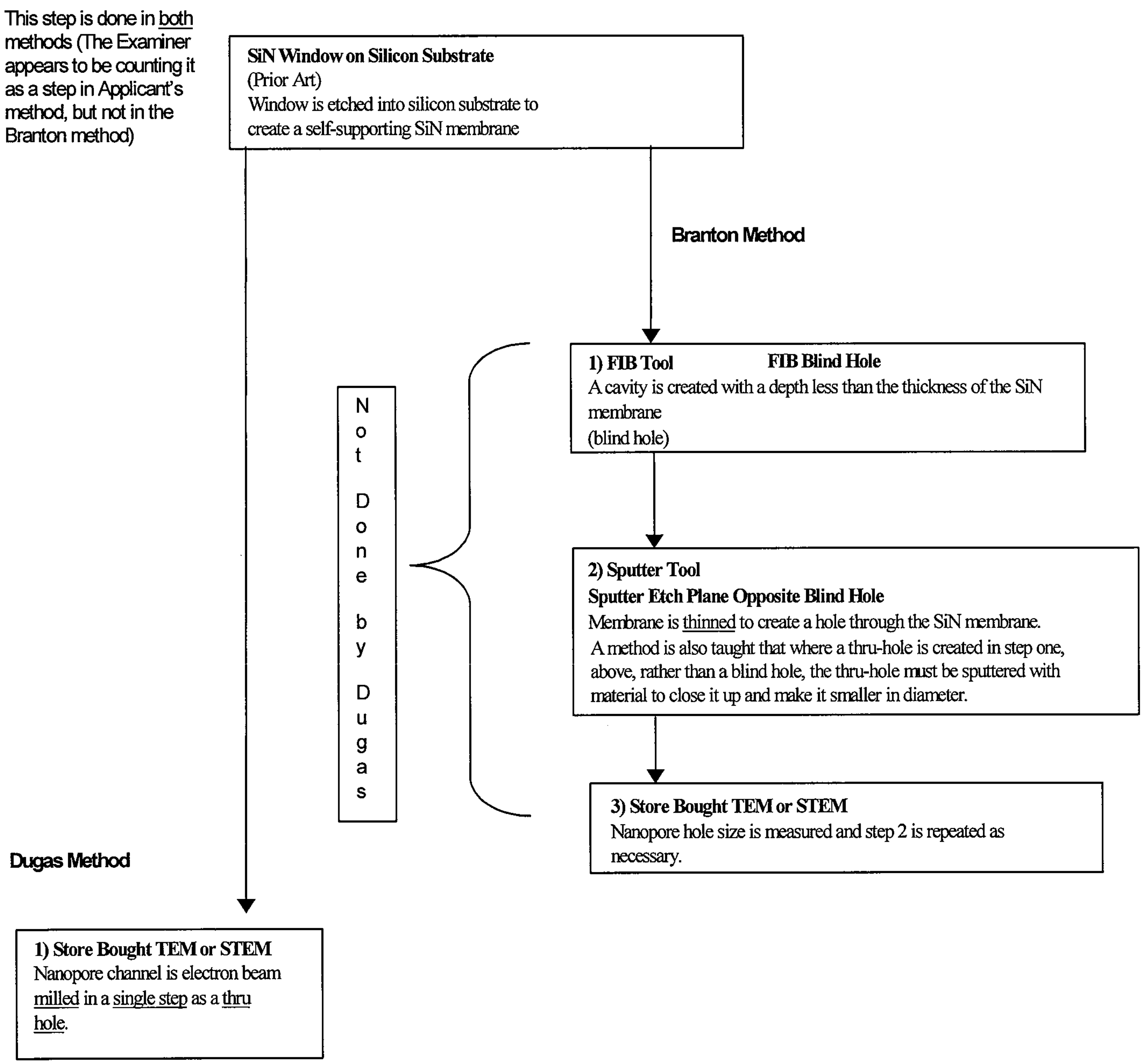
Thus, Branton does not disclose electron beam milling during either the cavity creation step or the thinning step. As such, nowhere does Branton disclose, teach, or suggest "electron beam milling a nano-scale channel entirely through a self supporting portion of the thin film." Branton merely discloses a required thinning step subsequent a cavity creation step.

Applicant further maintains that Branton teaches away from electron beam milling since neither step of cavity creation (required by Branton) nor thinning (required by Branton) is necessary with electron beam milling, as claimed by Applicant. Electron beam milling creates an aperture of appropriate size without the requirement of first etching a cavity nor the need to thin back the membrane. It is respectfully asserted that Applicant has clearly disclosed a novel technique of using direct electron beam milling to define a nano-scale channel. No intermediate cavity, such as disclosed and required by Branton, is necessary.

Branton Comprises More Steps Than Applicant's Method

The Examiner further asserts that Applicant's method is a two-step process including "a) a hole or window is etched in the silicon substrate and the lower layer of the thin film using standard lithography techniques, b) creating a channel (aperture) 75 by cutting through thin film 60 with electron beam milling (lithography)." Office Action dated May 9, 2007, p. 8. First, as noted above, Applicant does not equate electron beam lithography with electron beam milling. Second, as Applicant has previously stated, the step of etching a window in the silicon substrate is prior art and is done by both methods of Applicant and Branton.

As previously presented to the Examiner, and now presented in a simpler form for the Examiner's convenience, the diagram below compares the processes disclosed in Branton and in Applicant's application.



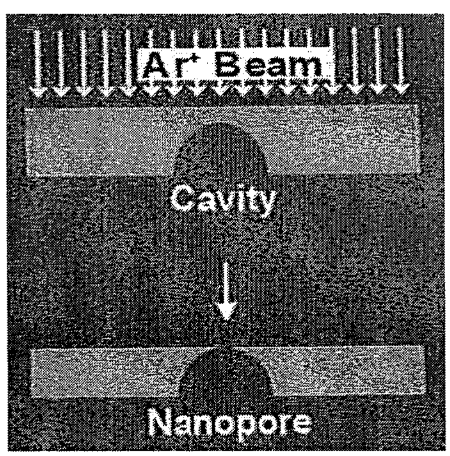
Applicant has never counted the additional window etching step as part of the two subsequent steps required by Branton. As stated above, subsequent to etching a window in the silicon, Branton requires 1) the step of cavity creation and 2) the step of thinning. Etching a window in the silicon substrate is not the same step as cavity creation disclosed in Branton. The step of cavity creation disclosed in Branton, as stated above and in prior responses, requires a cavity to be etched in the membrane 134 as shown in Fig. 4G. *See* Branton, Col. 13, ll. 3-5.

Typically, the cavity is created on the opposite side of the membrane as the silicon window. *See* Brangon, Col. 13, ll. 11-17. The cavity terminates "at an interior point in the membrane." Branton, Col. 13, ll. 45-46 (emphasis added); Fig. 4G. If the Examiner intends to count the step of etching a window in the silicon substrate as an additional step in Applicant's method (bringing Applicant's method to two steps), then Applicant respectfully asserts that the Examiner must also count the step of etching a window in the silicon substrate as an additional step in the Branton method, making the Branton method a three-step method.

Branton Does not Measure In-Situ Nor Mill and Measure During a Single Presentation to an Instrument

Applicant continues to maintain that Branton does not disclose, teach, or suggest "measuring the channel in-situ, wherein the milling and measuring are performed during a single presentation to an instrument." Branton merely discloses a feedback mechanism used during only the thinning step, i.e., the second step of a two-step process, in which both steps are required to form the resulting aperture. The aperture creation and the measuring are, thus, not "performed during a single presentation to an instrument."

Furthermore, the feedback mechanism of Branton is merely a mechanism used for obtaining an inferred, or indirect, estimation of the size of the aperture. "The feedback mechanism is based on detection of a physical species [such as Argon] provided during the thinning etch in a manner that is indicative of the physical dimensions of . . . an aperture." Branton, Col. 14, ll. 25-28. The following diagram illustrates the feedback mechanism.



Using the feedback mechanism disclosed in Branton, the amount of a physical species, e.g., Argon, pouring through the aperture, as it is widened by the thinning process, is detected. Once a certain amount of Argon is detected, the thinning process is caused to be halted. This is, in fact, not a measurement of the aperture, but merely an estimate of the size of the aperture. This method is not as accurate as measuring the channel in-situ. Furthermore, the feedback mechanism disclosed in Branton must be calibrated using direct measurements of the diameter of an aperture. Thus, Branton does not disclose "measuring the channel in-situ, wherein the milling and measuring are performed during a single presentation to an instrument."

In conclusion, Branton does not disclose, teach, or suggest, electron beam milling, in-situ measuring, or milling and measuring during a single presentation to an instrument. Particularly, Branton does not disclose, teach, or suggest "electron beam milling a nano-scale channel entirely through a self supporting portion of the thin film; and measuring the channel in-situ, wherein the milling and measuring are performed during a single presentation to an instrument," as recited in Applicant's Claim 19, and the above remarks obviate the basis for this ground of rejection.

Therefore, Claim 19 is not anticipated by Branton. Claims 24-42 and 45 depend from Claim 19, and incorporate all the limitations of Claim 19, and are also not anticipated by Branton. Reconsideration and withdrawal of the rejection is respectfully requested.

Rejections Under 35 U.S.C. § 103

Claim 20 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Branton et al. (U.S. Patent No. 6,627,067) in view of Nisch et al. (U.S. Patent No. 6,218,663). Applicant respectfully traverses the rejection for at least the following reasons.

Claim 19, as stated above, is directed to a method that comprises, in part, "electron beam milling a nano-scale channel entirely through a self supporting portion of the thin film; and measuring the channel in-situ, wherein the milling and measuring are performed during a single presentation to an instrument."

For the reasons stated above, Branton fails to disclose, teach, or suggest the invention of Claim 19. Instead, Branton discloses an aperture-forming process that requires two steps. The first step in the Branton process is a cavity-forming step that is performed with a lithographic instrument. *See* Branton, Col. 13, ll. 5-18. The second step is a thinning step that is performed by any of several processes except lithography. Branton, Col. 13, ll. 38-40. Furthermore, Branton discloses a feedback mechanism that is used only during one step of the aperture formation process resulting in more than one presentation to an instrument and merely provides an estimate of the aperture diameter, not a measurement of the aperture itself. Thus, Branton fails to teach or suggest "electron beam milling a nano-scale channel entirely through a self supporting portion of the thin film; and measuring the channel in-situ, wherein the milling and measuring are performed during a single presentation to an instrument."

Nisch fails to remedy the fundamental disclosure deficiencies of Branton. As noted in the Office Action, Nisch teaches ion etching for local thinning of a sample. *See* Nisch, Abstract. The purpose of Nisch is to "carry out target preparations under high-resolution observing conditions and to eliminate contaminant or reactive layers," such as an oxide layer. Nisch, Abstract. Thus, Nisch, at most, discloses one method of performing the second step – the thinning step – of the Branton method. In fact, Branton teaches that the thinning step can be performed by various ion beam methods. *See* Branton, Col. 14, ll. 14-16. Such a combination of Branton and Nisch thus results in an aperture-forming method that still requires more than a "single presentation to an instrument." Additionally, nothing in Branton or Nisch teaches or suggests modifying Branton's process such that it is performed during a single presentation to an instrument.

In fact, Branton teaches away from a single-step process of aperture formation. In Branton, the benefits of the first step - the cavity forming step – are discussed at length. That is, Branton teaches that the cavity forming step can be used to achieve "a desired cavity geometry." *See* Branton, Col. 13, l. 32. Further, Branton states that "[p]referably, given the characteristics of a selected cavity etch process, the cavity pattern extent is correspondingly selected to produce a desired extent at the cavity bottom, and to produce a range of cavity expanses between the cavity bottom and the membrane surface." Branton, Col. 13, ll. 48-52. Thus, the cavity forming step is

a vital part of the Branton invention. As such, Branton teaches away from milling a nano-scale channel through a self supporting portion of the thin film and measuring the channel, wherein the milling and measuring are performed during a single presentation to an instrument.

Thus, neither Branton nor Nisch, alone or in combination, teach or suggest "electron beam milling a nano-scale channel entirely through a self supporting portion of the thin film; and measuring the channel in-situ, wherein the milling and measuring are performed during a single presentation to an instrument" as recited in Applicant's Claim 19. Because claim 20 depends directly from claim 19 and incorporates all the limitations of Claim 19, the above remarks obviate the basis for this ground of rejection. Thus, Claim 20 is not made obvious by Branton in view of Nisch. Reconsideration and withdrawal of the rejection is respectfully requested.

New Claim 46

New Claim 46 depends from Claim 19, and incorporates all the limitations of Claim 19. Thus, Claim 46 is patentable at least for the reasons set forth above with respect to Claim 19 and the additional limitations set forth therein.

For example, Branton does not disclose a method, "wherein the nano-scale channel has substantially vertical side walls." As stated above, Branton requires 1) the step of cavity creation and 2) the step of thinning. Branton specifically discloses "[t]he cavity thins inward from the membrane surface to terminate at an interior point in the membrane." Branton, Col. 13, ll. 45-46. This is because "the aperture formation process of the [Branton] invention relies on structural thinning . . . to define the final aperture geometry." Branton, Col. 13, ll. 38-40. Thus, Branton does not disclose a channel having "substantially vertical side walls."

CONCLUSION

This response is being submitted on or before November 9, 2007, with the required fee of $465.00 for a three-month extension of time, making this a timely response. Applicant points out that a one-month extension of time had previously been requested, with the required fee of $60.00. It is believed that no additional fees are due in connection with this filing. However, the Commissioner is authorized to charge any additional fees or credit any overpayments to Deposit Account No. 04-1420.

This application now stands in allowable form and reconsideration and allowance is respectfully requested.

Respectfully submitted,

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